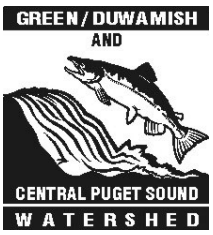
Final

Lower Duwamish Inventory Report

Prepared for:



and

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WRIA 9 Steering Committee

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1 INTRODUCTION

The purpose of this project was to document and locate instream, intertidal, and riparian habitat conditions in the Duwamish waterway through a field inventory, and to make this information available on a geographic information system (GIS). This effort addressed physical, biological, and anthropogenic conditions of the Duwamish Waterway. Information gathered from this project is intended to assist the Water Resource Inventory Area (WRIA) 9 Technical Committee with (1) developing an understanding of fish utilization of these habitat types, (2) understanding the linkages between juvenile salmonid survival and these habitat types in the Duwamish system, and (3) identifying and prioritizing specific habitats for protection and restoration. In addition, this effort will support regional salmon conservation and recovery plans, monitoring of long-term trends in salmonid habitat and ecosystem conditions, permitting requirements related to development projects, shoreline master plan updates, and assessment of project impacts to aquatic and riparian habitats.

1.1 STUDY AREA

This field inventory was conducted along the Duwamish Waterway from approximately River Mile 6 (just upstream of the turning basin) to the mouth of the river at the downstream end of Harbor Island excluding the northern Harbor Island shoreline (Figure 1-1)

1.2 APPROACH

This field inventory was designed by TerraLogic GIS and Landau Associates (consultant team) to be consistent with other inventory efforts, including the Lower Green River Baseline Habitat Monitoring Project completed by Anchor Environmental (Anchor) in 2003, and the inventories currently being conducted for the Duwamish Waterway Selected Habitat Monitoring Project by the National Oceanic and Atmospheric Administration (NOAA), and the City of Seattle/WRIA 9 Marine Shoreline Inventory by Anchor. Habitat parameters and field methodologies from these projects were reviewed and incorporated into this inventory, and parameters specifically requested by the WRIA 9 Technical Committee were added.

All field data collection was accomplished using Trimble Pro-XRS Global Positioning System (GPS) units with TSC1 data loggers and real-time differential correction. The data dictionary was designed specifically for this inventory and for integration into the GIS database. Collecting data in this manner allowed for standardized data entry, information processing, a lower possibility of lost data, and increased efficiency in the field.

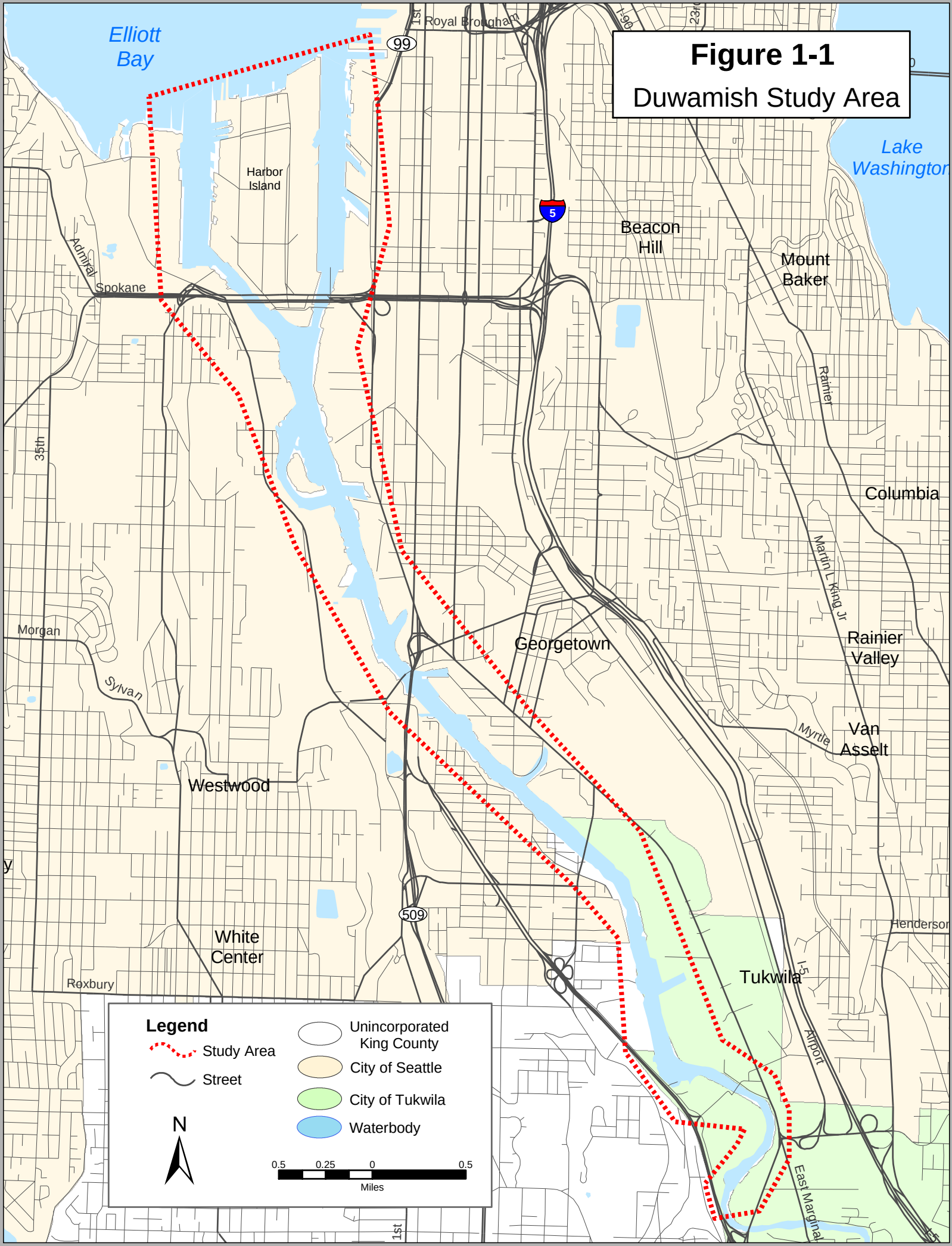
Figure 1-1
Duwamish Study Area
Elliott Bay
Lake Washington
Harbor Island
Beacon Hill
Mount Baker
Spokane
Admiral
35th
Rainier
Columbia
Martin L King Jr
Morgan
Sylvan
Georgetown
Rainier Valley
Myrtle
Van Asselt
Westwood
White Center
Roxbury
Tukwila
Henderson
I-5
Airport
East Marginal
1st
Royal Brougham
99
5
509
Legend
Study Area
Street
Unincorporated King County
City of Seattle
City of Tukwila
Waterbody
N
0.5 0.25 0 0.5
Miles

2 METHODS

Habitat features and attributes to be inventoried were determined by the consultant team in cooperation with WRIA 9 representatives. Existing spatial data were reviewed to determine gaps in available information and inventory methods developed to address these gaps. Habitat features, their attributes, and protocols for data collection were determined over a series of meetings. The final list of features to be collected, their attributes, and criteria for data collection are listed in Table 2-1 and include:

1. Riparian Vegetation
2. Invasive Species
3. Overwater Structures
4. Armoring
5. Woody Debris (individual pieces)
6. Drift Accumulations
7. Pilings (individual)
8. Piling Groups
9. Miscellaneous Features
10. Hand Launches
11. Impervious Surface

Habitat features and attributes were collected using a combination of field data collection and aerial photograph interpretation.

Table 2-1. Habitat features and attributes surveyed during the Lower Duwamish Inventory. For each feature, the data collected or classified are provided, as well as any criteria used to make classifications. The primary method to make classifications is also designated.

Feature Number	Feature	Feature Type (point/line)	Attribute	Data Collected / Classifications	Criteria	Method (Field/Office)
1	Riparian Vegetation	Continuous Line	Primary Layer	Mature Deciduous, Mature Coniferous, Immature Deciduous, Immature Coniferous, Native Shrub, Blackberry, Reed-Canary Grass, Other Grass, Landscaped/Ornamental, Invasive Shrub, Newly Restored, None	Primary/Secondary based on dominant percent cover, Mature = Estimated to be > 30 yrs., Minimum map unit = 20 m or at noticeable change in vegetation type	Field
			Secondary Layer	Mature Deciduous Mature Coniferous, Immature Deciduous, Immature Coniferous, Native Shrub, Blackberry, Reed-Canary Grass, Other Grass, Landscaped/Ornamental Invasive Shrub, Newly Restored, None	Primary/Secondary based on dominant percent cover, Mature = Estimated to be > 30 yrs., Minimum map unit = 20 m or at noticeable change in vegetation type	Field
			Average Width (from OHWM)	Meters	Average width of each line segment collected in the field was estimated from ortho-photographs	Office
			Number of Trees	Count		Field
			Proximity	Adjacent, Separated	Separated = Can't fall into water	Field

Feature Number	Feature	Feature Type (point/line)	Attribute	Data Collected / Classifications	Criteria	Method (Field/Office)
1	Riparian Vegetation	Continuous Line	Overhang	Meters	Estimated	Field
			Primary Cover	Percent	< 20, 21% to 40%, 41% to 60%, 61% to 80%, 81% to 100%	Field
			Secondary Cover	Percent	< 20, 21% to 40%, 41% to 60%, 61% to 80%, 81% to 100%	Field
2	Invasive Species	Point	Impervious Surface	Percent	0% to 10%, 11% to 75%, 76% to 100%	Office
			Species	Japanese Knotweed		Field
3	Overwater Structures	Polygon	Type	Dock, Pier, Marina, Building	Area without boats was digitized	Office

Feature Number	Feature	Feature Type (point/line)	Attribute	Data Collected / Classifications	Criteria	Method (Field/Office)
3	Overwater Structures	Polygon	Shape	Straight, "L", "T", Rectangle		Office
			Width	Meters (Estimated)		Office
			Length	Meters (Estimated)		Office
			Compass Orientation	Degrees		Office
			Capacity	Number of Boats		Office
		Point	Type	Dock, Pier, Marina, Building		Field
			Composition	Wood, Steel, Concrete,	Dominant composition element only	Field
			Support Condition	Good, Fair, Poor	Fair = Degraded, Poor = Failing	Field
			Support Count	Count		
			Support Material	Floating, Wood, Metal, Concrete		Field
			Overhang	Meters (average, estimated)		Field

Feature Number	Feature	Feature Type (point/line)	Attribute	Data Collected / Classifications	Criteria	Method (Field/Office)
4	Armor	Continuous Line	Type	Bulkhead-Pilings, Bulkhead-Concrete, Bulkhead-Steel, Concrete Boat Ramp, Rip Rap Boulder, Rip Rap Cobble, Rip Rap Asphalt/Concrete, Rip Rap and Timber/Pilings, Rip Rap Mixed, None-Hand Launch Ramp, None-Bank	Minimum map unit = 20 m or at noticeable change in vegetation type	Field
			Slope	Vertical, Sloped		Field
			Toe Elevation	Above MHHW, Below MHHW		Field
			Condition	Good, Fair, Poor	Fair = Degraded, Poor=Failing	Field
5	Woody Debris - Pieces	Point	Key Log	Log w/ Rootwad, Log	> 0.85 m diameter, > 10 m long, Not Embedded	Field
			Log	Small Log, Small Log w/ Rootwad Large Log, Large Log w/ Rootwad, Rootwad, Stump	Medium = 0.30 to 0.50 m in diameter, Large > 0.50 m in diameter, Rootwad > 2 m in diameter	Field
6	Drift Accumulations	Point	Restoration Area	Yes/No		Field
			Number of Pieces	Count	Estimated	Field
			Length of Accumulation	Meters	Estimated	Field

Feature Number	Feature	Feature Type (point/line)	Attribute	Data Collected / Classifications	Criteria	Method (Field/Office)
6	Drift Accumulations	Point	Width of Accumulation	Meters	Estimated	Field
			Restoration Area	Yes/No		Field
7	Pilings	Point	Type	Pilings, Dolphin, Pilings-Relic, Dolphins-Relic	Point will be collected for a set of < or = to 5 loosely grouped individual pilings in close proximity to each other	Field
			Composition	Wood, Steel, Concrete,		Field
			Condition	Good, Fair, Poor	Fair = Degraded, Poor = Failing	Field
8	Piling Groups	Point or Discrete Line	Type	Pilings, Bridge Armor, Building Supports, Other	> 5 single pilings	Field
			Composition	Wood, Steel, Concrete,		Field
			Width of Group	Meters	Estimated, Default = 1	Field
			Number of pilings in group	Count		Field
			Condition	Good, Fair, Poor	Fair = Degraded, Poor = Failing	Field

Feature Number	Feature	Feature Type (point/line)	Attribute	Data Collected / Classifications	Criteria	Method (Field/Office)
9	Miscellaneous	Point	Type	Permanent Barge, Dry Dock, Sunken Boat, Car, Tires, Wetland, Other		Field
			Location	Instream, Intertidal, Bank	Bank = Supratidal	Field
10	Hand Launches	Point	Comment	Hand Launch		Office
11	Impervious Surface				** See Riparian Vegetation	

2.1 FIELD DATA COLLECTION

A team of two people conducted the field inventory. The inventory was conducted entirely by boat. Two GPS units were connected to antennas attached to the bow of the boat, allowing for accurate placement of the antenna at the location of habitat features. In cases where the habitat feature could not be safely approached or where satellite reception was poor, an offset reading was recorded using the data logger. The offset angle was measured from magnetic north using a compass and field personnel visually estimated the offset distance.

All data were collected electronically using a data dictionary designed in GPS Pathfinder Office Pro, specifically for those habitat features agreed upon by the WRIA 9 Technical Committee (see the Habitat Features section below). Data were collected for these features along each bank and instream within the study area. Only those features visible and accessible from the boat were recorded in the field. Data was collected along the entire study area where each feature was located.

Where data collection required length and width datum, these measurements were estimated using a 2 meter measuring rod made of PVC pipe, marked in 10-centimeter increments. Distances greater than 2 meters were estimated by field personnel and rounded to the 2 meter increment.

The inventory was accomplished in three field days with an additional half day of spot checks for data verification. On the first day, riparian vegetation, invasive vegetation, aquatic vegetation, armoring, and woody debris were inventoried along one bank. On the second day, these same features were inventoried along the second bank. On the third day, overwater structures, pilings, substrate, and miscellaneous features were inventoried.

2.2 DATA MANAGEMENT AND EXPORT

Data stored in the data loggers were reviewed at the end of each day for consistency, completeness, and apparent accuracy. The data were downloaded from the data loggers to a laptop or desktop computer using Pathfinder Office software, stored on that computer hard drive, copied to the Landau Associates network files (for automated backup), and transferred electronically (via email) to TerraLogic GIS. This data management process assured safe storage of the files in several locations.

2.3 DATA CONVERSION AND GIS DATABASE DEVELOPMENT

Once field data files were received by TerraLogic GIS, custom routines and scripts were developed to automatically process field data collected daily into GIS coverages. In addition, processing routines incorporated QA/QC procedures to check for data consistency and validity. Certain features and feature attributes were unable to be collected in the field by boat. These features and attributes were collected using USGS 2002 Ortho Imagery. This photo interpretation process was used to delineate structure shape and chartacterize attributes for overwater structures (type, shape, width, length, orientation, and capacity). It was also used to characterize attributes for riparian vegetation (width and impervious surface).

2.4 HABITAT FEATURES AND ATTRIBUTES

Field monitoring was conducted using real-time differentially corrected geographic positioning system receivers and Trimble Pro-XRS TSC1 data loggers. Field parameters (i.e., Features) were measured to document shoreline conditions and, in some cases, to verify the position of features originally digitized using photo interpretation. The features and attributes documented during the field effort are described below.

2.4.1 Riparian Vegetation

Up to two layers of riparian vegetation were documented as a continuous line along both shorelines, above the ordinary high water mark (OHWM). The primary layer was defined as the dominant vegetation type (mature [greater than 30 years old] or immature deciduous forest, mature or immature coniferous forest, native shrub, blackberry, reed-canary grass, other grass, landscaped/ornamental, invasive shrub, or none) in any given length of shoreline. If a second vegetation type was present (e.g. a native shrub understory in a primarily deciduous forest vegetation type), a secondary layer was also documented. The average width of the riparian vegetation from the OHWM was documented when it could be determined from the river. The number of trees, proximity (adjacent or separated) of riparian vegetation to the OHWM, and amount of overhang (horizontal distance vegetation extends from the OHWM) were also documented along the entire length of shoreline. Finally, the percent cover of the primary and secondary (if present) layers was documented. A minimum distance of 20 m of similar vegetation was required before it was recorded as a primary or secondary vegetation type. Information

on impervious surface was collected from digital ortho-photographs. For each line segment defined by a riparian vegetation segment, the impervious surface within 200 feet of the shoreline was classified into three categories (high, medium, and low).

2.4.2 Invasive Species

The presence of Japanese knotweed was documented as a point feature wherever it was found along the shoreline.

2.4.3 Overwater Structures

The upstream corner, midpoint, or downstream corner, and type of structure (dock [floating], pier [elevated], marina, building, bridge) for all overwater structures was documented in the field to verify the location and types of the structures, which were originally digitized as polygons using photo interpretation. In addition, the dominant composition (wood, steel, concrete), support count, support material (floating, wood, metal, concrete), support condition (good, fair, poor), and length of overhang from the shoreline were documented in the field for each structure. Polygon features outlining each overwater structure were delineated based on digital ortho-photographs. Field data were used to ensure all structures were digitized and to characterize attributes that could not be done in the office (e.g., support material). Information on structure shape, capacity, orientation, width, and length were estimated in the office.

2.4.4 Bank Armor

Bank armoring was documented as a continuous line along both shorelines. The type (bulkhead-pilings, bulkhead-concrete, bulkhead-steel, concrete boat ramp, rip rap-boulder, rip rap-cobble, rip rap-asphalt/concrete, rip rap and timber/pilings, rip rap-mixed, none-bank), slope (vertical, sloped), toe elevation (above or below mean higher high water [MHHW]), and condition (good, fair, poor) were recorded. A minimum distance of 20 m of similar armoring was required before it was recorded as a distinct armor type.

2.4.5 Woody Debris

Individual pieces and accumulations of woody debris were documented as point features. No accumulations of woody debris were noted instream (i.e. log jams) so accumulations

were limited to drift along the shorelines. Individual pieces of woody debris were documented as either a "key log" or a "log". Key logs were logs with rootwads or logs that were greater than 0.85 m in diameter and greater than 10 m long. Any piece smaller than this was documented as a small log (less than 0.3 m in diameter), small log with rootwad, medium log (0.3 to 0.5 m in diameter), medium log with rootwad, large log (greater than 0.5 m in diameter), large log with rootwad, a rootwad (when roots extend to greater than 2 m in diameter), or a stump. For accumulations of woody debris along the shoreline (drift), the estimated number of pieces, length of the accumulation, and width of the accumulation were documented. Finally, it was documented whether individual pieces or accumulations of woody debris occurred in areas where stream/shoreline restoration efforts had occurred.

2.4.6 Pilings

The locations of pilings not associated with other structures were documented as point features. Lines of pilings (i.e., a row with more than 5 pilings and/or greater than 10 m long) were documented as a discrete line. The type of piling(s) (piling, dolphin, piling-relic, dolphin-relic), composition (wood, steel, concrete), and condition (good, fair, poor) were recorded for each piling or group of pilings. A group of pilings was considered a dolphin if it contained three or more pilings wrapped together with rope, cable, or chain.

2.4.7 Hand Launches

The location of hand boat launches was collected in the field and augmented with data received from the Seattle Public Utilities

2.4.8 Miscellaneous

Miscellaneous information of possible use to WRIA 9 was collected in the field and augmented with information from Seattle Public Utilities. This includes data on wetlands adjacent to the study area.

2.5 QUALITY ASSURANCE/ QUALITY CONTROL

As mentioned previously, the GPS data dictionary was generated in Trimble Pathfinder Office and downloaded into the GPS data loggers. All files in the project used the same data dictionary. This procedure ensured the standardization of data entry and data processing. Data collected were verified each field day, before and after downloading into the Pathfinder software. To ensure data collection accuracy, on the third day a minimum of 20 previously documented habitat features (both line and point) were re-recorded along both banks of the river. The location and attributes associated with these re-recorded features were compared to the original measurements to determine consistency of data interpretation for that feature and accuracy of feature location.

Variability in data collection was controlled by training all field crew members in each part of the data dictionary prior to conducting the field inventory and by limiting the number of field crew members to two with one alternate, to be used only in the event that one of the primary field crew members was unable to be present. The field crew always consisted of a minimum of two people so that data interpretation could be discussed and standardized in the field, before data was entered in the data logger.

During the field inventory, a data point was recorded for each overwater structure. The midpoint or corner of the structure was measured. This allowed for evaluation of the accuracy of aerial photographic interpretation in relation to the actual location for those structures on the ground.

Programs created to convert field collected GPS data into a GIS format incorporated routines to check for attribute accuracy, completeness, and consistency. Any errors encountered during this process were reviewed with field crews. Subsequent field visits for data validation were conducted as need. Following incorporation of the data files into the GIS database, one field crewmember reviewed the data and graphical output for completeness and accuracy. This review was conducted with TerraLogic personnel to allow for real-time discussion and resolution of any identified discrepancies.

3 RESULTS

This section provides a general quantitative assessment of key attributes of each habitat feature and describes the example figures included in this section to illustrate habitat GIS data (Table 2). The final deliverable from this field effort consists of GIS habitat layers in digital format for the Duwamish Waterway.

3.1 SUMMARY INFORMATION

Table 3-1. Habitat Feature Summary

Habitat Attribute	Total number of miles	Percent of surveyed area	Area covered (feet^2)	Count
Shoreline Armoring				
Bulkhead-Concrete	2.57	11.66%		
Bulkhead-Pilings	1.70	7.71%		
Bulkhead-Steel	2.77	12.56%		
Concrete Boat Ramp	0.15	0.68%		
Rip Rap Asphalt/Concrete	0.47	2.13%		
Rip Rap Boulder	11.56	52.43%		
Rip Rap Cobble	0.19	0.86%		
RipRap-Timber/Piling	0.14	0.63%		
None- Bank	2.50	11.34%		
Total	22.05	100.00%		
Riparian Vegetation – Primary Layer				
Mature Deciduous	0.04	0.18%		
Mature Coniferous	0.00	0.00%		
Immature Deciduous	0.67	3.04%		
Immature Coniferous	0.03	0.14%		
Native Shrub	0.00	0.00%		
Blackberry	6.60	29.92%		
Reed Canary Grass	0.03	0.14%		
Other Grass	0.33	1.50%		
Landscaped/Ornamental	2.10	9.54%		
Invasive Shrub	1.36	6.17%		
Newly Restored	0.24	1.09%		
None	10.65	48.28%		
Total	22.05	100.00%		
Riparian Vegetation - Overhanging				
Yes	5.18	23.46%		
No	16.87	76.54%		
Total	22.05	100.00%		

Habitat Attribute	Total number of miles	Percent of surveyed area	Area covered (feet^2)	Count
Impervious Surface				
0% to 10%	0.99	4.49%		
11% to 75%	1.80	8.17%		
76% to 100%	19.26	87.34%		
Total	22.05	100.00%		
Overwater Structures				
Bridge			378798.63	11
Building			171733.66	7
Dock			61946.20	18
Marina			166679.55	12
Pier			2032700.55	66
Total			2811858.59	114
Piling Groups				
Bridge Armor	2721.03			11
Other	97.82			2
Pilings	14140.69			43
Total	16959.54			56
Individual Pilings				
Dolphin				51
Dolphins-Relic				2
Pilings				26
Pilings-Relic				24
Total				103
Large Woody Debris Pieces				
Key Log				8
Key Log w/Rootwad				10
Large Log				8
Large Log w/Rootwad				2
Small Log				14
Small Log w/Rootwad				1
Rootwad				2
Stump				4
Total				49
Drift Accumulations				2
Invasive Species				
Japanese Knotweed				14
Hand Launches				6
Wetlands				3

3.2 FIGURE EXAMPLES

The following figures depict examples of the spatial data collected in this inventory and provided as a deliverable along with this report.

- Figure 3-1 - Lower Study Area Habitat Feature 1
- Figure 3-2 – Upper Study Area Habitat Features 1
- Figure 3-3 – Lower Study Area Habitat Features 2
- Figure 3-4 – Upper Study Area Habitat Features 2
- Figure 3-5 – Overwater Structures Example

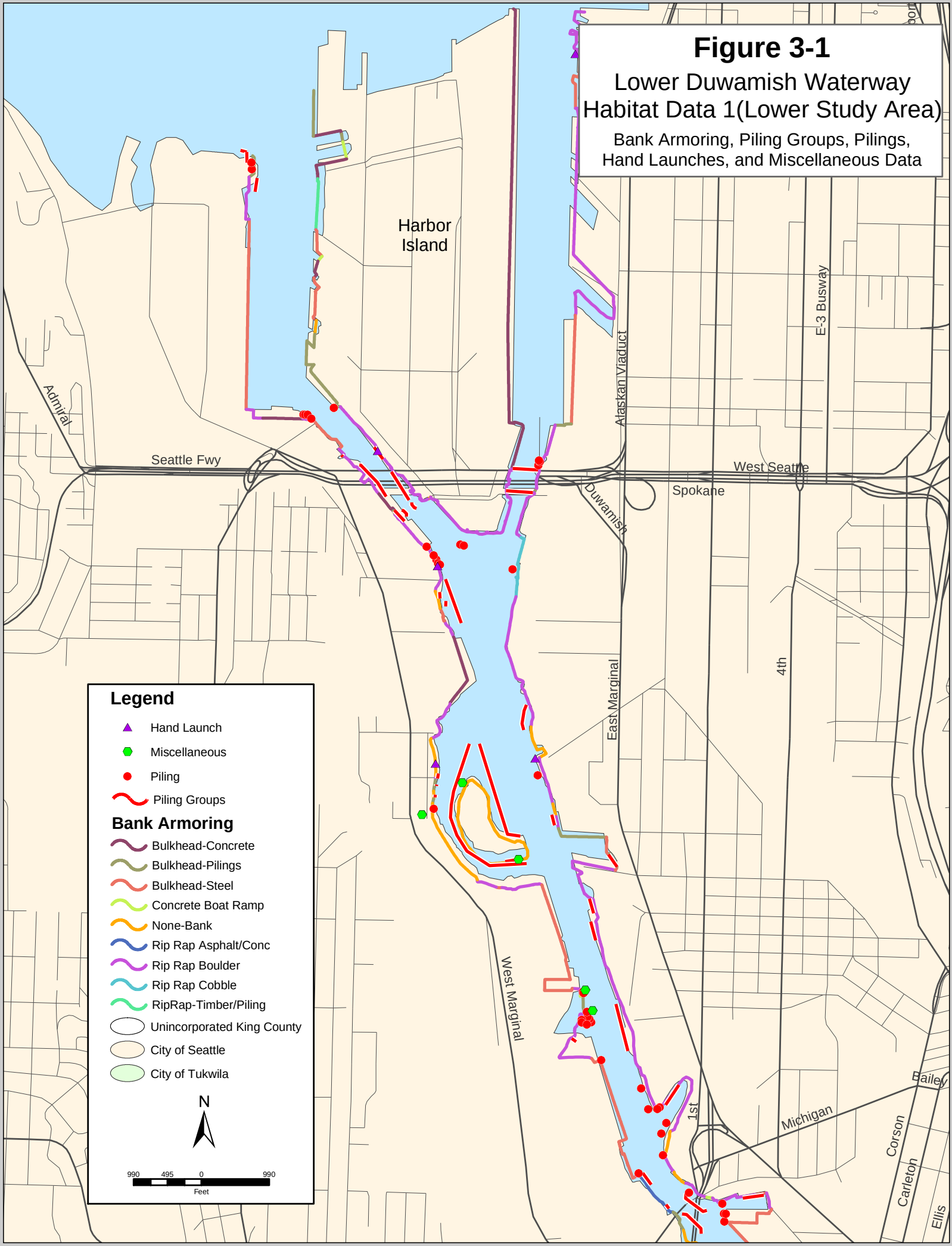
Figure 3-1
Lower Duwamish Waterway
Habitat Data 1(Lower Study Area)
Bank Armoring, Piling Groups, Pilings,
Hand Launches, and Miscellaneous Data
Harbor Island
Admiral
Seattle Fwy
Alaskan Viaduct
E-3 Busway
West Seattle
Spokane
Duwamish
East Marginal
4th
West Marginal
1st
Michigan
Bailey
Corson
Carleton
Ellis
Legend
Hand Launch
Miscellaneous
Piling
Piling Groups
Bank Armoring
Bulkhead-Concrete
Bulkhead-Pilings
Bulkhead-Steel
Concrete Boat Ramp
None-Bank
Rip Rap Asphalt/Conc
Rip Rap Boulder
Rip Rap Cobble
RipRap-Timber/Piling
Unincorporated King County
City of Seattle
City of Tukwila
N
990 495 0 990
Feet

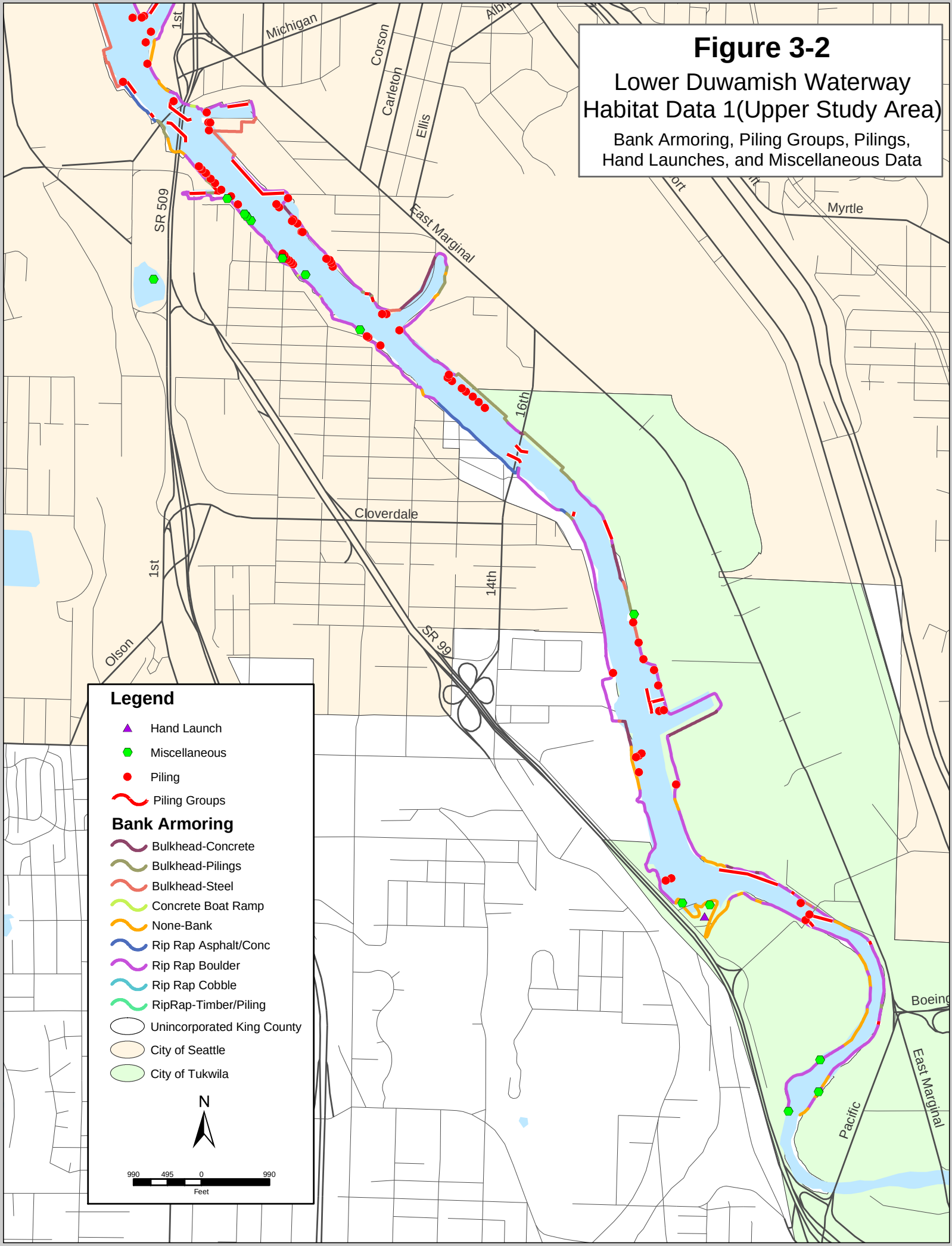
Figure 3-2
Lower Duwamish Waterway
Habitat Data 1(Upper Study Area)
Bank Armoring, Piling Groups, Pilings,
Hand Launches, and Miscellaneous Data
Michigan
Corson
Carleton
Ellis
East Marginal
SR 509
Myrtle
16th
Cloverdale
14th
SR 99
1st
Olson
Boeing
Pacific
East Marginal
Legend
Hand Launch
Miscellaneous
Piling
Piling Groups
Bank Armoring
Bulkhead-Concrete
Bulkhead-Pilings
Bulkhead-Steel
Concrete Boat Ramp
None-Bank
Rip Rap Asphalt/Conc
Rip Rap Boulder
Rip Rap Cobble
RipRap-Timber/Piling
Unincorporated King County
City of Seattle
City of Tukwila
N
990 495 0 990
Feet

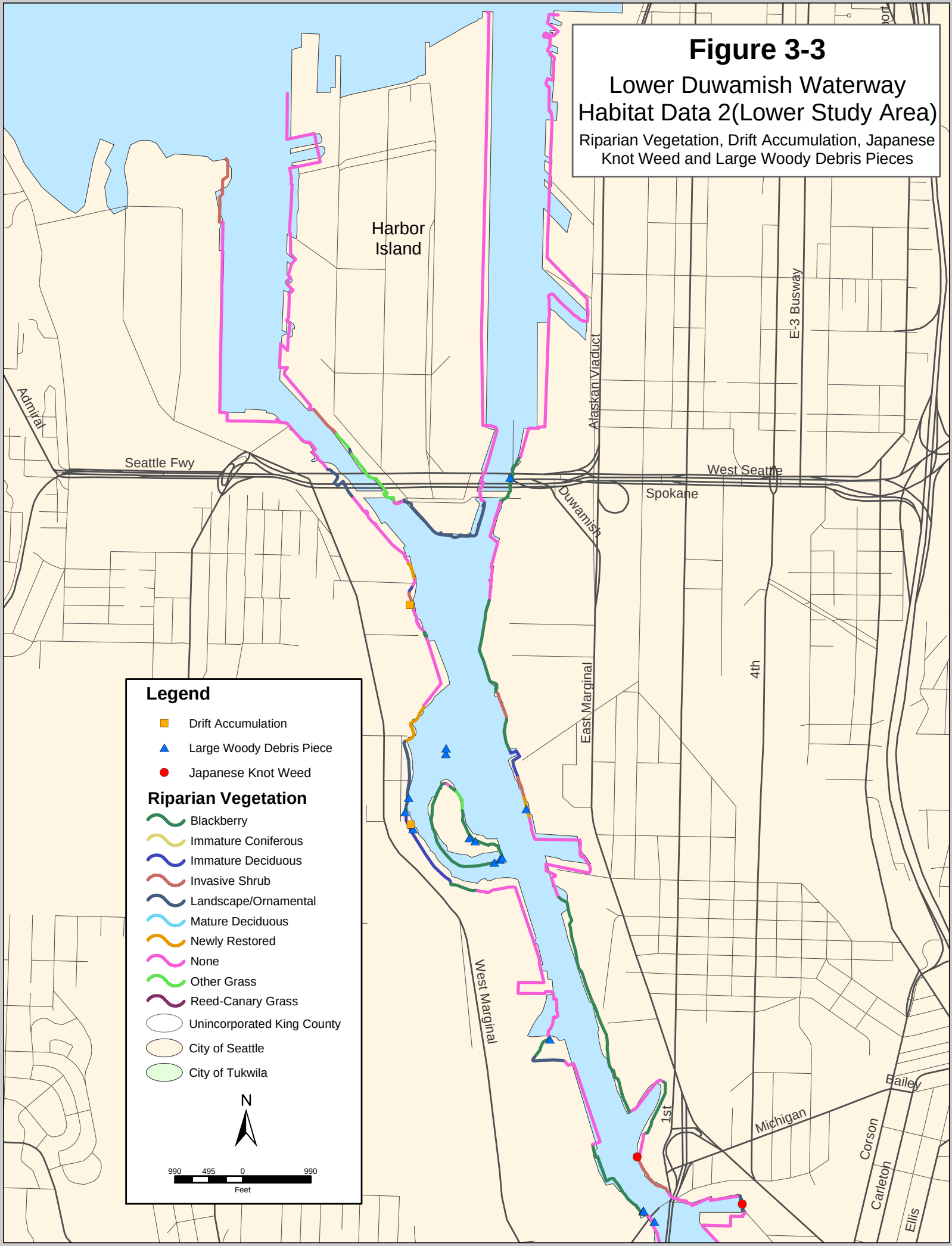
Figure 3-3
Lower Duwamish Waterway
Habitat Data 2(Lower Study Area)
Riparian Vegetation, Drift Accumulation, Japanese Knot Weed and Large Woody Debris Pieces
Harbor Island
Admiral
Seattle Fwy
Alaskan Viaduct
E-3 Busway
West Seattle
Spokane
Duwamish
East Marginal
4th
West Marginal
1st
Michigan
Bailey
Corson
Carleton
Ellis
Legend
Drift Accumulation
Large Woody Debris Piece
Japanese Knot Weed
Riparian Vegetation
Blackberry
Immature Coniferous
Immature Deciduous
Invasive Shrub
Landscape/Ornamental
Mature Deciduous
Newly Restored
None
Other Grass
Reed-Canary Grass
Unincorporated King County
City of Seattle
City of Tukwila
N
990 495 0 990
Feet

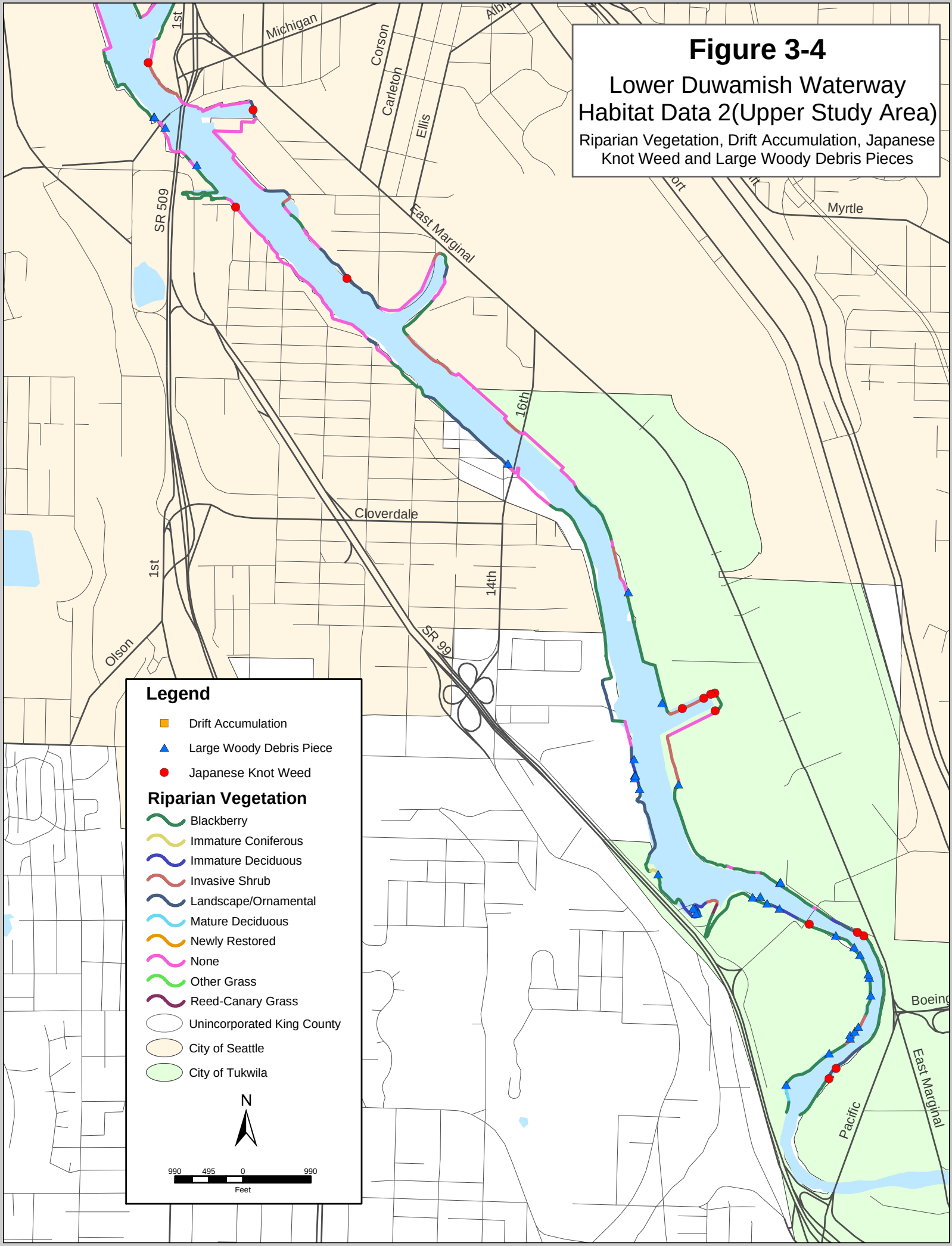
Figure 3-4
Lower Duwamish Waterway
Habitat Data 2(Upper Study Area)
Riparian Vegetation, Drift Accumulation, Japanese Knot Weed and Large Woody Debris Pieces
1st
Michigan
Corson
Carleton
Ellis
SR 509
East Marginal
Myrtle
16th
Cloverdale
1st
14th
Olson
SR 99
Pacific
East Marginal
Legend
Drift Accumulation
Large Woody Debris Piece
Japanese Knot Weed
Riparian Vegetation
Blackberry
Immature Coniferous
Immature Deciduous
Invasive Shrub
Landscape/Ornamental
Mature Deciduous
Newly Restored
None
Other Grass
Reed-Canary Grass
Unincorporated King County
City of Seattle
City of Tukwila
N
990 495 0 990
Feet


Figure 3-5
Overwater Structure Example
Overwater Structure Type
Bridge
Building
Dock
Marina
Pier
N
100
50
0
100
Feet

4 USE OF THIS REPORT

This Field Methodology Report has been prepared for the exclusive use of Seattle Public Utilities and the WRIA 9 Technical Committee for specific application to the Duwamish River Habitat Inventory. No other party is entitled to rely on the information, conclusions, and recommendations included in this document without the express written consent of TerraLogic GIS or Landau Associates. Further, the reuse of information, conclusions, and recommendations provided herein for extensions of the project or for any other project, without review and authorization by TerraLogic GIS or Landau Associates, shall be at the user's sole risk. TerraLogic GIS and Landau Associates warrants that within the limitations of scope, schedule, and budget, our services have been provided in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions as this project. We make no other warranty, either express or implied.

This document has been prepared under the supervision and direction of the following key staff.

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DLB/RAB/acw

5 REFERENCES

Anchor Environmental. 2003. *Lower Green River Habitat Monitoring Project.* Prepared for King County Water and Land Resources. November.

APPENDIX 1. DATA DICTIONARY

Riparian Vegetation

Associated Files: rip_ln.shp, rip_ln.dbf, rip_ln.shx, rip_ln.sbn, rip_ln.sbx, rip_ln.prj

Layer Description: Characterization of riparian vegetation adjacent to shoreline. Data collected from a boat by collecting start, mid, and end locations of vegetation types.

Fields:

[SHAPE]: Type of geographic representation calculated by GIS

Values:

PolyLine

[LENGTH]: Length of shoreline feature in feet

Values:

(Calculated Value): Length of segment calculated by GIS

[ID]: Internal ID

Values:

(Calculated Value): ID generated by GPS

[PRM_LYR]: Primary vegetation type along shoreline based on dominant percent cover

Values:

Blackberry
Immature Coniferous
Immature Deciduous
Invasive Shrub
Landscape/Ornamental
Mature Deciduous
Mature Coniferous
Native Shrub
Newly Restored
None
Other Grass
Reed-Canary Grass

[SCD_LYR]: Secondary vegetation type along shoreline based on percent cover

Values:

Blackberry
Immature Coniferous
Immature Deciduous
Invasive Shrub
Landscape/Ornamental
Mature Deciduous
Mature Coniferous
Native Shrub
Newly Restored
None
Other Grass
Reed-Canary Grass

[WIDTH_FIEL]: Estimated width of riparian vegetation collected in field

Values:

(Width): Estimated width in meters

[WIDTH_ORTH]: Estimated width of riparian vegetation collected from digital ortho-photography

Values:
(Width): Estimated width in meters
[NO_TREES]: Number of trees in the section of shoreline counted in the field
Values:
(Number): Number of trees
[PROXIMITY_]: Proximity of riparian vegetation to water
Values:
Adjacent: Can fall into water
Separated: Can not fall into water
[OVERHANG]: Distance riparian vegeration overhangs water
Values:
(Number): distance in meters
[PRM_COV]: Percent cover of primary vegetation type in classes estimated in field
Values:
<20%
21% to 40%
41% to 60%
61% to 80%
81% to 100%
[SCD_COV]: Percent cover of secondary vegetation type in classes estimated in field
Values:
<20%
21% to 40%
41% to 60%
61% to 80%
81% to 100%
[imp_surfac]: Percent impervious surface within 200 feet of shoreline segment estimated from digital ortho-photography
Values:
0% to 10%
11% to 75%
76% to 100%
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Armor

Associated Files: armor_ln.shp, armor_ln.dbf, armor_ln.shx, armor_ln.sbn, armor_ln.sbx, armor_ln.prj
Layer Description: Characterization of Armor adjacent to shoreline. Data collected from a boat by collecting start, mid, and end locations of armor types
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:

PolyLine
[LENGTH]: Length of shoreline feature in feet
Values:
(Calculated Value): Length of segment calculated by GIS
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[TYPE]: Primary armor type along shoreline.
Values:
Bulkhead-Pilings,
Bulkhead-Concrete,
Bulkhead-Steel,
Concrete Boat Ramp,
Rip Rap Boulder,
Rip Rap Cobble,
Rip Rap Asphalt/Conc.,
Rip Rap and Timber/Pilings,
Rip Rap Mixed,
None-Hand Launch Ramp,
None-Bank
[SLOPE]: Bank Slope
Values:
Vertical
Sloped
[TOE_ELEVAT]: Channel Toe Elevation
Values:
Above MHHW
Below MHHW
[CONDITION]: Bank Armoring Condition
Values:
Good
Fair
Poor
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Large Woody Debris Drift Accumulation

Associated Files: drift_acc.shp, drift_acc.dbf, drift_acc.shx, drift_acc.sbn, drift_acc.sbx, drift_acc.prj
Layer Description: Large woody debris drift accumulations.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:

Point
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[NO_PIECES]: Number of pieces(wood) in the section of shoreline counted in the field
Values:
(Number): Number of pieces
[LENGTH]: Estimated length of accumulated wood pieces
Values:
(Length): Estimated length in meters
[WIDTH]: Estimated width of accumulated wood pieces
Values:
(Width): Estimated width in meters
[RESTORATIO]: Previous restoration project
Values:
Yes
No
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Large Woody Debris Pieces

Associated Files: lwdp_pt.shp, lwdp_pt.dbf, lwdp_pt.shx, lwdp_pt.sbn, lwdp_pt.sbx, lwdp_pt.prj
Layer Description: Large woody debris individual pieces.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
Point
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[KEY_LOG]: Log greater than 0.85 meters in diameter, greater than 10 meters long and not embedded
Values:
Log w/Rootwad
Log
[LOG]: Log size and characteristics
alues:
Small Log
Small Log w/Rootwad
Large Log
Large Log w/Rootwad
Rootwad
Stump

[RESTORATIO]: Previous restoration project
Values:
Yes
No
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Hand Launch

Associated Files: hlaunch.shp, hlaunch.dbf, hlaunch.shx, hlaunch.sbn, hlaunch.sbx, hlaunch.prj
Layer Description: Hand Launch.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
Point
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Invasive Species

Associated Files: inv_jkw.shp, inv_jkw.dbf, inv_jkw.shx, inv_jkw.sbn, inv_jkw.sbx, inv_jkw.prj
Layer Description: Invasive Species – Japanese Knotweed.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
Point
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[SPECIES]: Invasive Species
Values:
Japanese Knotweed
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments

[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Miscellaneous

Associated Files: misc_pt.shp, misc_pt.dbf, misc_pt.shx, misc_pt.sbn, misc_pt.sbx, misc_pt.prj
Layer Description: Miscellaneous Data.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
Point
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[TYPE]: Miscellaneous Type
Values:
Permanent Barge
Dry Dock
Sunken Boat
Car
Tires
Wetland
Other
[LOCATION]: Location of Miscellaneous data.
Values:
Instream
Intertidal
Bank
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Overwater Structures

Associated Files: ow_pl.shp, ow_pl.dbf, ow_pl.shx, ow_pl.sbn, ow_pl.sbx, ow_pl.prj
Layer Description: Overwater structures.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
PolyLine
[AREA]: Area of overwater structure feature in feet
Values:

(Calculated Value): area calculated by GIS

[PERIMETER]: Perimeter of overwater structure feature in feet

Values:

(Calculated Value): perimeter calculated by GIS

[LOCATION]: Location of GPS point relative to overwater structure

Values:

Upstream Corner
Downstream Corner

[ID]: Internal ID

Values:

(Calculated Value): ID generated by GPS

[TYPE]: Overwater structure type

Values:

Dock
Pier
Marina
Building

[SHAPE_1]: Structure Shape

Values:

Straight
"L"
"T"
Rectangle

[LENGTH]: Estimated length of overwater structure

Values:

(Length): Estimated length in meters

[WIDTH]: Estimated width of overwater structure

Values:

(Width): Estimated width in meters

[ORIENTATIO]: Orientation of waterward face of structure in 45 degree increments.

Values:

(Degrees)

[CAPACITY]: Boat capacity of Marinas.

Values:

(Number): Number of boats (999 if not a marina)

[TYPE]: Type of overwater structure

Values:

Dock
Pier
Marina
Building

[COMPOSITIO]: Overwater structure composition

Values:

Wood
Steel
Concrete

[SPRT_COND]: Condition of overwater structure supports

Values:

Good
Fair

Poor
[SPRT_COUNT]: Number of overwater structure supports
Values:
(Number): Number of supports
[SPRT_MAT]: Overwater structure support material
Values:
Floating
Wood
Metal
Concrete
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Pilings (Individual)

Associated Files: pile_pt.shp, pile_pt.dbf, pile_pt.shx, pile_pt.sbn, pile_pt.sbx, pile_pt.prj
Layer Description: Individual Pilings, less than 5 loosely grouped.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
Point
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[TYPE]: Piling Type
Values:
Pilings
Dolphin
Pilings-Relic
Dolphins-Relic
[COMPOSITIO]: Piling composition
Values:
Wood
Steel
Concrete
[CONDITION]: Condition of piling
Values:
Good
Fair
poor
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS

Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

Pilings (Group)

Associated Files: pileg_ln.shp, pileg_ln.dbf, pileg_ln.shx, pileg_ln.sbn, pileg_ln.sbx, pileg_ln.prj
Layer Description: Group of Pilings, greater than 5.
Fields:
[SHAPE]: Type of geographic representation calculated by GIS
Values:
Polyline
[LENGTH]: Length of piling group feature in feet
Values:
(Calculated Value): Length of segment calculated by GIS
[ID]: Internal ID
Values:
(Calculated Value): ID generated by GPS
[TYPE]: Piling Type
Values:
Pilings
Dolphin
Pilings-Relic
Dolphins-Relic
[COMPOSITIO]: Piling composition
Values:
Wood
Steel
Concrete
[WIDTH]: Estimated width of piling group
Values:
(Width): Estimated width in meters
[NO_PILINGS]: Number of pilings counted.
Values:
(Number): Number of pilings
[CONDITION]: Condition of piling group.
Values:
Good
Fair
Poor
[COMMENT1]: Comments or observations from field crew
Values:
(Text): Comments
[DATE_OF_CR]: Date of data collection from GPS
Values:
(Date): Date of data collection
[TIME]: Time of data collection from GPS
Values:
(Time): Time of data collection

APPENDIX 2. METADATA